

Information Processing and Precision Measurements using Spin Qubits in Diamond

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Abstract: The field of quantum optics has led to the development of radically new ways to compute, communicate, and measure with quantum states. Enabled by recent advances in quantum control and nanofabrication, it is now becoming possible to realize quantum technologies in scalable semiconductor systems, building on the dramatic achievements of semiconductor technology in past decades. In the first part of this talk, I will describe our recent work towards photonic integrated chips to control information in the form of single photons and single electron spins in the nitrogen vacancy (NV) center of diamond. The second part of the talk will discuss new directions in precision measurements based on manipulation of the NV spin. This includes the development of electron spin-based optical biosensors and their use in optical imaging and sensing, as well as precision clocks based on the precise manipulation of ensembles of NV spins using a novel magnetic-field insensitive spin protocol.